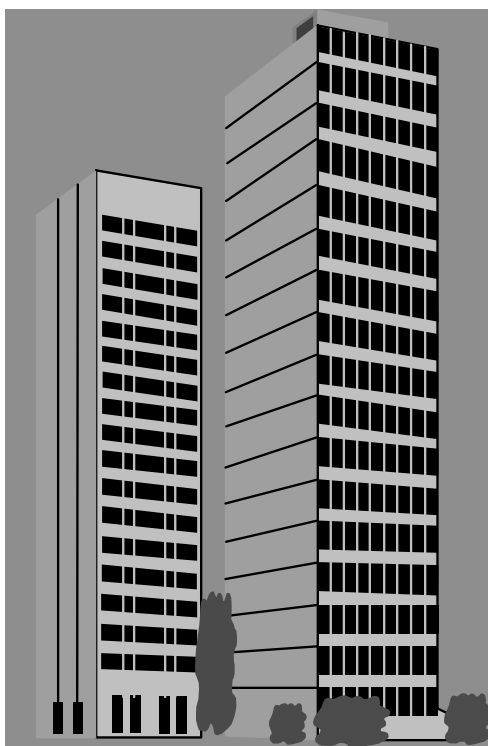


## **Appendix II**

**Indoor Air Quality Assessment  
MCCT  
Grand Jury Room and The Grand Jury Administration Office (Floor 3)  
40 Thorndike Street  
Cambridge, Massachusetts  
August 1999**

# **INDOOR AIR QUALITY ASSESSMENT**

**Cambridge Superior Court  
Grand Jury Room  
Middlesex County Courthouse  
3<sup>rd</sup> Floor  
40 Thorndike Street  
Cambridge, MA**



Prepared by:  
Massachusetts Department of Public Health  
Bureau of Environmental Health Assessment  
August, 1999

## **Background/Introduction**

In response to a request from Rosa Chavez, facility manager of the Cambridge Court Complex, an indoor air quality assessment was conducted in the grand jury room and adjacent offices (the grand jury area) on the third floor of the Cambridge Superior Court at the Middlesex County Courthouse, 40 Thorndike Street, Cambridge, Massachusetts. This assessment was conducted by the Massachusetts Department of Public Health (MDPH), Bureau of Environmental Health Assessment (BEHA). Complaints of chemical-like odors in the grand jury room and the grand jury administration office were made by staff. Visits were made to this building by Michael Feeney, Chief of Emergency Response/Indoor Air Quality (ER/IAQ) on June 18, 1999 and June 21, 1999.

The grand jury area is located on the third floor of a twenty-three story multi-level building. This evaluation focused on the Grand Jury Room 3-59 and the grand Jury Administration Office 3-59 (see Picture 1). Also included in this evaluation were the jury dining rooms on the second floor. The building does not have openable windows. The windows are single paned and have tinting to reduce solar glare (NIOSH, 1990).

## **Methods**

Air tests for carbon dioxide were taken with the Telaire, Carbon Dioxide Monitor and tests for temperature and relative humidity were taken with the Mannix, ThPen PTH8708 Hygrometer/Thermometer. Air tests for carbon monoxide and hydrogen sulfide were taken with a BW Technologies, Model # D4-2000, Multigas detector. Screening for total volatile organic compounds (TVOCs) was conducted using an HNU

Systems, Photo Ionization Detector (PID). Water content in ceiling tiles was measured with a Delmhorst, BD-2000 Model, Moisture Detector with a Delmhorst Standard Probe. The wall cavity was examined using a Professional Equipment Borescope.

## **Results**

The grand jury area has an employee population of approximately 5 and an estimated 20 individuals use the facilities on a daily basis. The tests were taken under normal operating conditions. Test results appear in Table 1.

## **Discussion**

### **Ventilation**

It can be seen from the tables that carbon dioxide levels were below 800 parts per million parts of air [ppm] in all areas sampled. These carbon dioxide levels are indicative of an adequate fresh air supply in this area. Ventilation is provided by a heating, ventilation and air-conditioning (HVAC) unit located in mechanical rooms in the basement. Fresh air is supplied by a combination of ceiling mounted air diffusers and induction units located at the base of windows.

Exhaust ventilation on these floors is provided by ducted, return air vents that are connected to each air-handling unit. Exhaust vents are also located in the basement of the Middlesex Court House.

In order to have proper ventilation with a mechanical supply and exhaust system, the systems must be balanced to provide an adequate amount of fresh air to the interior of a room while removing stale air. The date of the last servicing and balancing of these systems could not be identified at the time of the visit.

The Massachusetts Building Code requires a minimum ventilation rate of 20 cubic feet per minute (cfm) per occupant of fresh outside air or have openable windows in each room (SBBRS, 1997). The ventilation must be on at all times that the room is occupied. Providing adequate fresh air ventilation with open windows and maintaining the temperature in the comfort range during the cold weather season is impractical. Mechanical ventilation is usually required to provide adequate fresh air ventilation.

Carbon dioxide is not a problem in and of itself. It is used as an indicator of the adequacy of the fresh air ventilation. As carbon dioxide levels rise, it indicates that the ventilating system is malfunctioning or the design occupancy of the room is being exceeded. When this happens a buildup of common indoor air pollutants can occur, leading to discomfort or health complaints. The Occupational Safety and Health Administration (OSHA) standard for carbon dioxide is 5,000 parts per million parts of air (ppm). Workers may be exposed to this level for 40 hours/week (OSHA, 1997).

The Department of Public Health uses a guideline of 800 ppm for publicly occupied buildings. A guideline of 600 ppm or less is preferred in schools due to the fact that the majority of occupants are young and considered to be a more sensitive population in the evaluation of environmental health status. Inadequate ventilation and/or elevated temperatures are major causes of complaints such as respiratory, eye, nose and throat irritation, lethargy and headaches.

Temperature readings were within a range of 72° to 73° F. The BEHA recommends that indoor air temperatures be maintained in a range between 70° to 78° F in order to provide for the comfort of building occupants. In many cases concerning indoor air quality, fluctuations of temperature in occupied spaces are typically experienced, even in a building with an adequate fresh air supply.

The relative humidity in this building was within the BEHA recommended comfort range in the majority of areas sampled. Relative humidity measurements ranged from 42 to 46 percent. The BEHA recommends that indoor relative humidity is comfortable in a range of 40-60 percent. The sensation of dryness and irritation is common in a low relative humidity environment. Low relative humidity is a very common problem during the heating season in the northeast part of the United States.

### **Other Concerns**

On June 18, 1999, a varnish like odor was detected within the Grand Jury Room 3-55. This odor was traced to a hole in the interior wall between this room's windows (see Picture 2). Carbon monoxide and hydrogen sulfide were not detected in any of the indoor/outdoor samples collected during this assessment. A strong draft of air was noted moving from the wall cavity into the Grand Jury Room through this hole. A similar odor was noted in the adjacent Grand Jury Administration Office, 3-59. In no other area within the grand jury area was an odor detected. Court officials reported that ceiling tiles in the second floor cafeteria and jury dining rooms were painted with an acoustic paint. Upon discovering this fact, the jury dining rooms that are directly beneath the grand jury room were examined to ascertain whether off gassing constituents of the paint was the source of this odor. Both the jury dining rooms and hallway had painted ceiling tiles (see Pictures 3 & 4). No odors were noted on the second floor. Court officials were asked to temporarily seal the hole in the Grand Jury Room with duct tape to prevent further penetration of the odor into this area.

On June 21, 1999, Mr. Feeney returned with equipment to conduct air sampling for volatile organic compounds in the Grand Jury Area, the wall cavity and the jury

dining rooms. Upon entering the Grand Jury Room, no odor was detected. The duct tape seal on the wall cavity hole was removed and the interior of this cavity was examined with a borescope. The wall cavity appears to have space between the exterior wall and the floor decking. This space can serve as a pathway between the third floor and the second floor ceiling plenum. VOC air samples were taken within the wall cavity by inserting the PID probe into the wall cavity. While VOC levels within the room were found at background (outdoor) air levels [0.6 parts per million (ppm)], air samples taken from within the wall cavity were measured at 1.5 ppm, which indicates an off gassing material within this space. All TVOC measurements throughout the Grand Jury level were at outdoor background level. The hole was resealed with duct tape.

Moisture content of ceiling tiles in the jury dining rooms were measured to ascertain whether moistened ceiling tiles were painted, resulting in an extended drying time. Ceiling tiles immediately adjacent to fresh air diffusers and exhaust vents as well as randomly chosen ceiling tiles not adjacent to ventilation equipment were evaluated. Randomly selected ceiling tiles not adjacent to ventilation system equipment had a moisture content of 0 %. Ceiling tiles immediately adjacent to and within approximately three feet of the air diffusing unit and the exhaust unit of the dining room, had a moisture content between 8-9.5% (see Picture 5). This indicates that there is trapped moisture within these ceiling tiles.

As noted by the low carbon dioxide levels measured during this and previous assessments in other parts of the building (MDPH, 1999), the heating, ventilation and air-conditioning system introduces a large amount of fresh air into the building. It is believed that these ceiling tiles were painted during a time of high relative outdoor humidity. During hot, humid days, the intake of large amounts of fresh air also

introduces water vapor into the HVAC system. Materials nearest ventilation equipment, such as ceiling tiles, can become coated with a layer of moisture.

If this moisture is covered with paint, the ceiling tile does not have a means to allow for moisture to evaporate. In addition, with moisture sealed against the tile, paint constituents would not dry as rapidly as if it were applied to a dry surface. The exterior surface of the paint will dry, leaving the surface of the paint in contact with the ceiling tile wet. This condition can lead to extended drying times, which can lead to off gassing of VOCs from moistened ceiling tiles. Since the ceiling tile system in the jury dining rooms is closest in distance to the grand jury area and, an air movement pathway exists between the second and third floor, it is likely that TVOCs from off gassing paint had entered the grand jury room through the wall hole and into the grand jury office through electrical outlet holes or wall seams around the window induction unit.

Enhancing the draw of air from the wall cavity in the Grand Jury Administrative Office is the configuration of the induction unit, ceiling-mounted fresh air diffusers and exhaust vent. At some previous time, a wall was constructed which divides the induction unit and the ceiling-mounted fresh air diffuser from the exhaust vent. With the door closed, no exhaust ventilation exists in this office (see Pictures 6 & 7). Without exhaust ventilation with the door closed, TVOC odors can build up in this space.

## **Conclusions/Recommendations**

The following steps can be employed to reduce odors from TVOCs in the grand jury area.

1. Seal all wall holes permanently with spackle. Seal all wall seams around the induction units with an appropriate seam sealing compound.

2. As a temporary measure to prevent TVOC movement into the grand jury administration office seal electrical outlets to serve as a TVOC barrier.
3. Once the grand jury area is sealed, employ exhaust ventilation to dry the ceiling tiles. Since the building does not have openable windows, exhaust ventilation has to be directed into the interior of the building. If this is done, exhaust ventilation should only be done after business hours, preferably on the weekend when there are minimal amounts of employees in the building. Please note that exhaust ventilation may not succeed in reducing odors, since moisture is sealed within the tiles.
4. If exhaust ventilation is not practical or does not succeed, consider replacing the ceiling tiles in two layers around each ceiling mounted vent (see Picture 8).

## References

MDPH. 1999. Indoor Air Quality Assessment Cambridge District Court, Middlesex County Courthouse, 13<sup>th</sup>, 14<sup>th</sup> & 15<sup>th</sup> Floors, Cambridge, Massachusetts. Massachusetts Department of Public Health, Bureau of Environmental Health Assessment, Boston, MA.

NIOSH. 1990. Letter to John Buonomo, County Administrator from Edward Kaiser, Regional Industrial Hygienist, NIOSH, Concerning Indoor Air Quality and Asbestos, dated October 24, 1990. National Institute for Occupational Health and Safety, Region 1, Boston, MA. HETA 89-238.

OSHA. 1997. Limits for Air Contaminants. Occupational Safety and Health Administration. Code of Federal Regulations. 29 C.F.R. 1910.1000 Table Z-1-A.

SBBRS. 1997. Mechanical Ventilation. State Board of Building Regulations and Standards. Code of Massachusetts Regulations. 780 CMR 1209.0

**Picture 1**

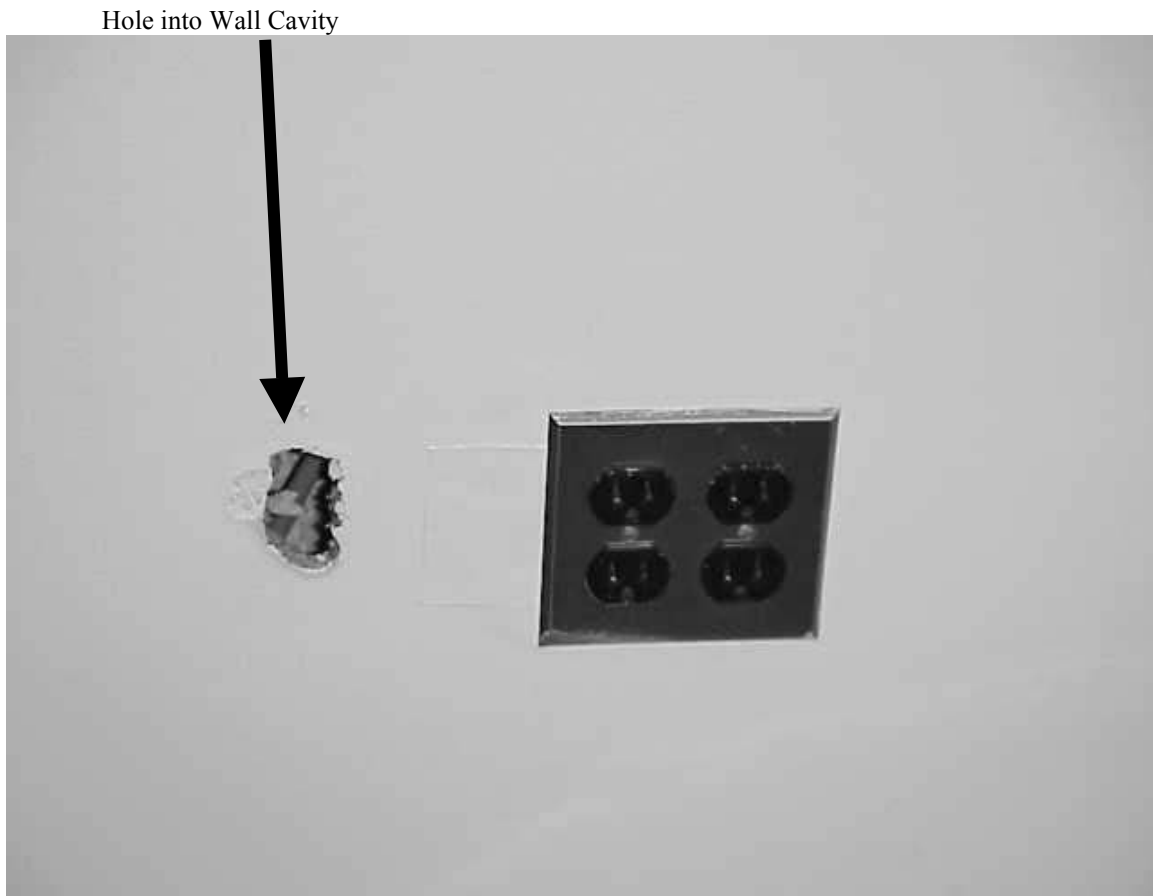
Grand Jury Room

Grand Jury Administration Office



**Grand Jury Area**

**Picture 2**



**Hole in Wall of Grand Jury Room**

**Picture 3**



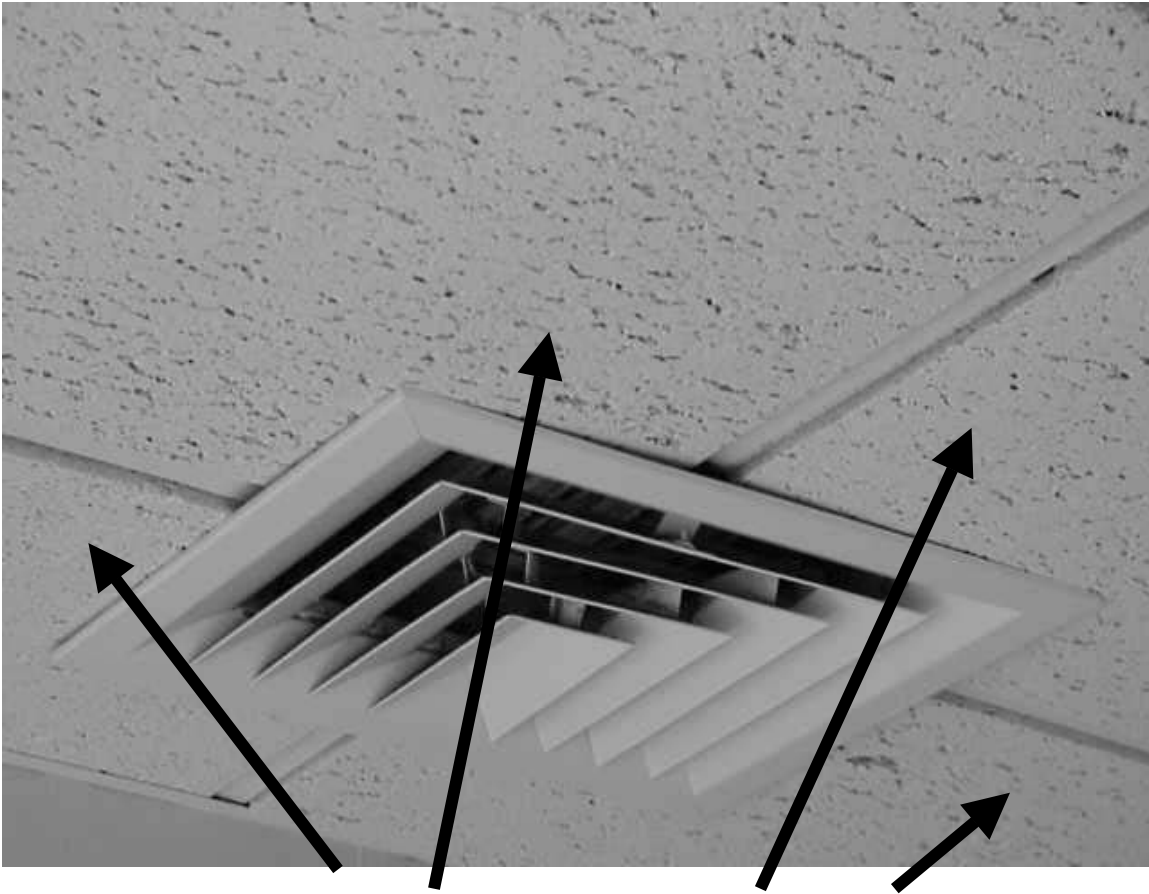
**Jury Dining Room below Grand Jury Administrative  
Office with painted Ceiling Tiles**

**Picture 4**



**Jury Dining Room Hallway with Painted Ceiling Tiles**

**Picture 5**



**Example of Moistened Ceiling Tiles around Air  
Diffuser Sampled for Water Content**

**Picture 6**



**Ceiling without Exhaust Vent in the Grand Jury Administration Office**

**Picture 7**

Grand Jury Administrative  
Office Exhaust Vent



**Exhaust Vent Outside of the Grand Jury Administrative Office**

**Picture 8**



**Ceiling Tiles Recommended for Removal if this Option is Chosen**



## TABLES

### Indoor Air Test Results – Cambridge Superior Court, Grand Jury Room, Cambridge – June 18, 1999

Location	Carbon Dioxide *ppm	Carbon Monoxide *ppm	Hydrogen Sulfide Gas	TVOCs (taken on 6/21)	Temp. °F	Relative Humidity %	Occupants in Room	Operable Windows	Ventilation		Remarks
									Intake	Exhaust	
Outside (Background)	455	0	0	0.6	74	46					
Grand Jury 3-55	499	0	0	0.6	72	44	0	no	yes	yes	odor from hole in wall cavity
3-59	553	0	0	0.6	73	44	0	no	yes	no	exhaust in hallway
Grand Jury Hallway	470	0	0	0.6	73	46	0	no	no	no	
Jury Dining Hall 2-75	444	0	0	0.6	73	42	0	no	yes	yes	painted ceiling tiles
2 <sup>nd</sup> Floor Hallway	493	0	0	0.6		43	0	no	yes	yes	painted ceiling tiles
Wall Cavity of Grand Jury				1.5							

\* ppm = parts per million parts of air

CT = water-damaged ceiling tiles

#### Comfort Guidelines

Carbon Dioxide -	< 600 ppm = preferred 600 - 800 ppm = acceptable > 800 ppm = indicative of ventilation problems
Temperature -	70 - 78 °F
Relative Humidity -	40 - 60%